43. Outline of the Cambrian Faunas of Siberia*.

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(Comm. by T. KATO, M.I.A., April 12, 1943.)

The Cambrian formation is extensively distributed in the Central Siberian platform and in the folded zone of Southern Siberia. In this zone the intrageosynclinal volcanism and the crustal movement of the Salair phase took place in the Cambrian period (Vologdin, 1937 B,-C). The glacial sediments formerly thought to lie in the lower part of the formation have since been proven to be Proterozoic in age (Tschurakow, 1937). The calcareous facies are dominant in the middle part of the Cambrian formation; salt and gypsum deposits are mostly found in the platform near the base of the upper and the top of the lower part; and archaeocyathid limestone is also wide-spread in the passage between the lower and middle parts. On the whole they suggest that Siberia was generally warm and sometimes hot and dry in the Cambrian period.

The formation yields various fossils which have been described by Schmidt, Toll, Holm and Westergard, Vologdin, Lermantova, Poletayeva and other palaeontologists. The trilobites and archaeocyathids are the leading members of the fauna, and Vologdin has made a comprehensive study on the archaeocyathids. I had an opportunity some ten years ago to make a study on the trilobite collection made by Tolmachoff in the Chatanga-Anabar basin. I wish therefore to give an outline of the Cambrian faunas of Siberia on the basis not only of published facts but also of my own observations, with special reference to the trilobites.

Although the existing knowledge on Lower Cambrian trilobites is still meager, there are a few facts which suggest the invasion of the *Olenellus thompsoni* fauna from the Appalachian province into Novaya Zemlya and probably farther into Central Siberia. An illustration of a complete carapace of *Bathynotus* from Novaya Zemlya was given in Ermolaef's paper (1931) and the occurrence of *Bathynotus holopyge* in association with *Agraulos namanensis* Lermantova is reported from a limestone bed of the Namana, a tributary of the Lena (Obrutschew, 1926).

Since Toll had described the Archaeocyathids from Torgoshino near Krasnoyarsk in 1899, Russian geologists have shown that the distribution of the archaeocyathid limestone in Siberia and Central Asia is quite extensive. In Central Siberia it is known to be distributed from

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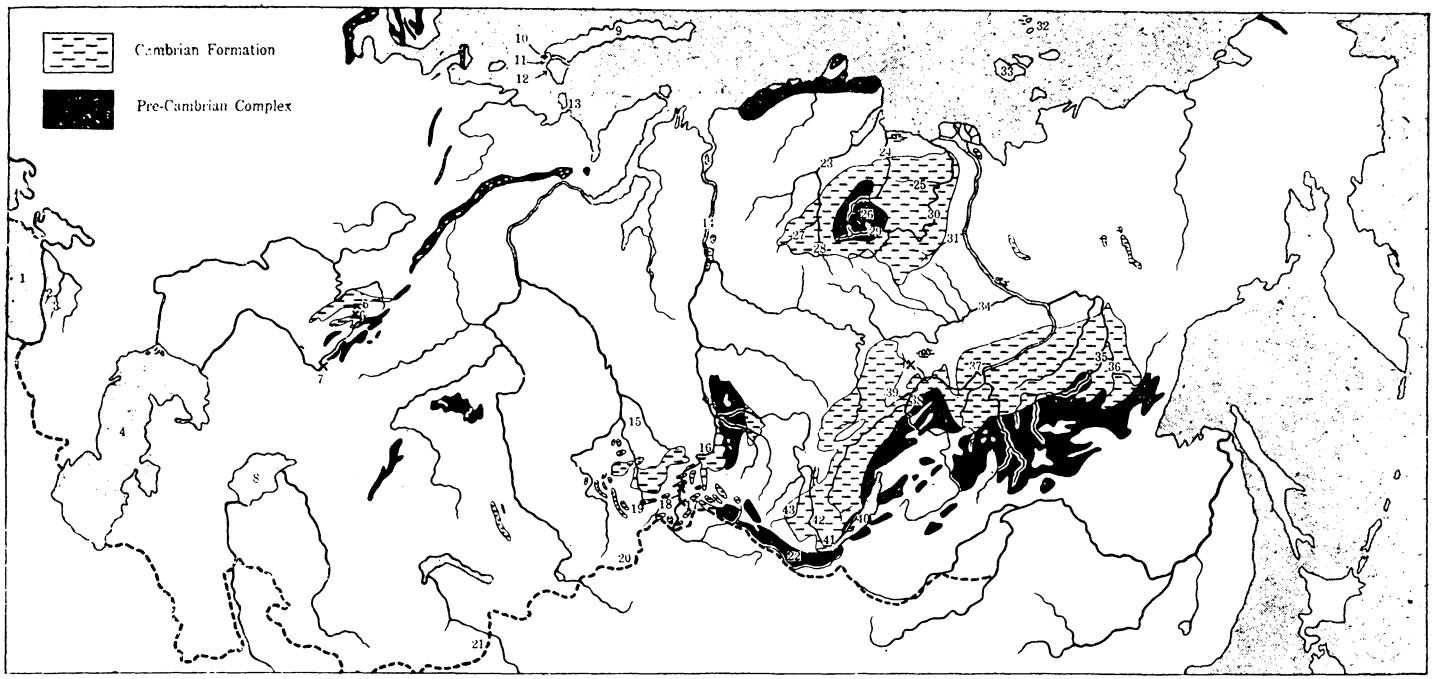
* Miscellaneous Notes on the Cambro-Ordovician Geology and Palaeontology No. 14.

** I wish to acknowledge the courtesies of Dr. I. P. Tolmachoff of the Carnegie Museum, Pittsburge, Pa. for the privilege of studying his valuable collection, of Prof. B. F. Howell of the Princeton University, N. J. for his advice on my study and also of Prof. T. Kato for reading this paper at the meeting of the Academy. I wish also to thank the Department of Education for the research grant.

*** This is a preliminary note of my study on the subject. Its complete result is to be published in my paper entitled "Cambrian Faunas of Siberia" now in preparation.

Map showing the Distribution of the Cambrian Formation in U. S. S. R.



1. Black Sea
2. Malaja-Laba
3. Bolschaja-Laba
4. Caspian Sea
5. Bakalsk
6. Satka
7. Orsk
8. Aral Sea
9. Novaya-Zemlya
10. Matochkin-scharr Strait
11. Bassimyamt
12. Powerskay
13. Waigatch Island
14. Yenissei River
15. Salair Mountains
16. Krasnoyarsk and Torgoshino nearby
17. Minussinsk
18. Abakan River
19. Kuznetsk basin
20. Alatau Mountains
21. Tienshan Mountains
22. Sayan Mountains
23. Chatanga or Khatanga River
24. Anabar River
25. Koika River
26. Anabar Massive
27. Kotui River
28. Moyero River
29. Argassala River
30. Muna River
31. Bennett Island
32. New Siberian Islands
33. Wilui River
34. Aldan River
35. Maja River
36. Olekminsk
37. Witim
38. Peledui River
39. Baikal Lake
40. Irkutsk
41. Balagansk
42. Oka

the Aldan and Maja tributaries on the southeast to the Chatanga-Anabar basin on the northwest side (Nalivikin, 1936). On the southwest side it occurs in several places in the so-called folded zone—more precisely, in the Eastern and Western Sayans, the Salair mountains, the Kuznetsk Alatau, the Southern Altai and the southwestern Tienshan and Kazakstan—and extends farther to the west into the South Ural mountains and the Laba basin in Northern Caucasus.

Prior to Toll's publication two Devonian trilobites, *Proetus* (*Phateon*) *slatkowskii* and *Cyphaspis sibirica*, were described by Schmidt (1886) and one Carboniferous plant, *Calamites cannaeformis*, by Meglizki (1850), all from the vicinity of Krasnoyalsk, the last of which is according to Hekker (1928) nothing but an archaeocyathid. The two trilobites were referred to various genera by Toll, Walcott (1914), Whitehouse (1936, 39) and myself (1935 A). As a result of this study I found that *slatkowskii* to belongs *Kootenia* while *sibirica* represents an undescribed genus for which I propose a new name, *Paratollaspis*. On the early Middle Cambrian age of this trilobite faunule I agree with Lermantova and other geologists because *Kootenia* is much more common in the Middle than in the Lower Cambrian and *Paratollaspis* is related to *Tollaspis* mentioned below. Incidentally the two species are reported also from the Minussinsk Mountains (Edelstin, 1925).

Anomocare pawlowskii Schmidt and *Liostracus*? *maydelli* Schmidt from a locality at the mouth of the Little Batobiji between Witimsk and Olekminsk on the Wiliu river are two trilobites which were incorrectly referred to different genera by Toll and Walcott. The former species is the type of *Tollaspis* which I established in 1935, and the latter can be safely referred to it. It is certainly interesting that a faunule comprising *Tollaspis* cfr. *pawlowskii Manchuriella septentrionalis* Kobayashi and *Manchuriella sibirica* Kobayashi is found in grey limestone at three localities on the Esseigan river in the Chatanga-Anabar basin.

Furthermore it is a remarkable fact that *Tollaspis* (?) *poletayevae* Kobayashi is found in association with Middle Cambrian trilobites, archaeocyathids and other fossils in the Sanashtikgolsky limestone at the Sanashtikgolsky spring on a tributary of the river Abakan on the northern slope of the West Sayans (Poletayeva, 1936). As a result of my revision (1924 A) this fauna comprises

Kootenia abacanensis (Poletayeva),
Poliella (*Poliellina*) *laermantovi* Poletayeva,
Poliella (*Poliellina*) *laermantovi* var. *alta* Poletayeva,
Poliella (*Poliellina*) *sayanicus* Poletayeva,
Poliella (*Poliellina*)? *anomalis* Poletayeva,
Tollaspis (?) *poletayevae* Kobayashi,
Chakasshia minussensis Poletayeva, and
Inouyina quadrata Poletayeva,

beside indeterminable solenopleurids and others. Although the faunas of Torgoshino, Sanashtikgolsky, the Wiliu and the Esseigan are fairly distinct from one another suggesting a slight difference in their ages, their assemblages as a whole reveal a relationship to the early Middle Cambrian faunas of the Pacific or Arcto-Pacific province. A high

percentage inclusion of endemie genera is also remarkable. The Peledui fauna from a siliceous limestone bed on the Peledui, a tributary of the Lena, belongs I think probably to this general group of fauna, because it contains *Olenoids sibiricus* Lermantova. *Solenopleura bella* Lermantova and *Ptychoparia* ? *rschonsnizkii* Lermantova, (Obrutschew, 1924). Furthermore it is certain that *Poliella* (*Poliellina*) *obrutchevi* (Lermantova) from the Tchernhoka mining district, Irkutsk, belongs to the same faunal group. (Lermantova, 1926 B).

The Argassala fauna which was found in a fossil bed 200 to 300 m. above the archaeocyathid limestone on the southern slope of the Anabar massive is, on the other hand, probably a little younger. It consists of *Acrotreta rojkovi* Lermantova, *Pagetia ferox* Lermantova, *Agnostus anabarensis* Lermantova, *Oryctocephalus* sp., *Ptychoparia tkatschenkoi* Lermantova and *Dorypyge moori* Lermantova (Vologdin, 1937 A). Its alliance to the Pacific fauna can hardly be overlooked, because *Pagetia*, *Oryctocephalus* and *Dorypyge* are listed.

When Toll described the below listed fauna from the junction of the Ssinjaja on the left bank of the Lena, below Olekminsk, he considered that this fossil bed was synchronous with, but heteropic from, the Torgoshino limestone. More precisely speaking, the latter indicates a deep facies whereas the former represents a shallow one. Furthermore he correlated the two with the *Holmia kjerulfi* zone.

Kutorgina cingulata Billings	
? *Obolella chromatica* Billing	
Hyolithes ? sp. undt.	
Microdiscus kochi Toll	*Ciceragnostus*
Microdiscus lenaicus Toll.....	*Ciceragnostus*
Microdiscus sp. undt.	
Agnostus schmidti Toll	*Phalacroma*
? *Olenellus* sp. undt.	
Ptychoparia czekanowskii Toll	*Levisia*
Ptychoparia meglitzkii Toll.....	*Lorenzella* ?

Although *Olenellus* (?) sp. undt. was not illustrated, it is by no means a member of the Olenellidae, because from its description it can be understood that the facial suture of this trilobite is not fused. The classificatory positions of the other fossils were variously discussed by Walcott (1914), Cobbold (1931) and by myself (1935 A, 1939). Generic names written on the right side in the list show the results of my determination. The inclusion of *Ciceragnostus* and *Phalacroma* evidently reveal the affinity of this fauna with the Middle Paradoxidian on the one hand while *Levisia* together with *Lorenzella* (?) suggest that its relation to the Western Pacific fauna was still maintained. Incidentally, *Protolenus asiatidus* Lermantova and *Solenopleura bituberculata* Lermantova were later added to the fauna (Obrutchew, 1924), but whether *Protolenus* really occurs in a horizon so high up needs a re-examination.

Although no *Paradoxides* has as yet been discovered in Siberia, the invasion of the late Paradoxidian fauna into Siberia can definitely be concluded by the wide distribution of the *Centropleura* fauna there. Holm and Westergård were the first to describe this interesting fauna which had been found in a dark gray shale in Bennett island by Toll

during the Russian Polar expedition, 1900–1903 (Loc. A in list I). The two palaeontologists, when they described it in 1930, concluded that it is a clear parallel to the fauna of the Scandinavian zone of the *Paradoxides forchhammeri* zone. Long before this contribution *Bathyuriscus howelli* Walcott, *Agnostus czekanowskii* Schmidt and *Helminthoidichnites* sp. were described from the Olenek formation in the water-shed between the Olenek and Monjere (Loc. E). This faunule

Fossil List I. The *Centropleura* fauna in Siberia.

Locality. (See pages 209, 210)	A	B	C	D	E
Helminthoidichnites sp.					×
Micromitra (?) sp.	×				
Lingulella (?) sp.	×				
Acrotreta (?) sp.	×				
Eoorthis wichitaensis Walcott				×	
Brachiopods undt.	×				
Phalacroma glandiformis (Angelin)	×		×		
Phalacroma glandiformis angustifrons (Lermantova).				×	
Phalacroma nudus hyperboreus (Holm and Westergård)	×		×		
Phoidagnostus bituberculatus (Angelin)	×		×	×	
Lejopyge laevigatus (Dalman) (or *Cotalagnostus altus* (Grönwall)		×			
Hypagnostus globiceps (Lermantova)				×	
? *Hypagnostus parvifrons* (Linnarsson)		×		×	
Clavagnostus repandus (Holm and Westergård)	×				
Clavagnostus (?) *czekanowskii* (Schmidt)					×
Perenopsis fallax (Linnarsson)			×	×	
Linguagnostus arcticus (Holm and Westergård)	×				
Linguagnostus kjerulfi (Brögger)				×	
Goniagnostus aculeatus micropunctatus (Lermantova).		×			
Triplagnostus gibbus hybrida (Brögger)		×			
Agnostus pisiformis pater Holm and Westergård	×				
Agnostids spp.	×				
Centropleura lovedi (Angelin)	×		×		
Centropleura sp.		×			
Corynexochus macrophthalmas Lermantova		×			
Corynexochus aff. *bornholmensis* (Grönwall)			×		
Proampyx acuminatus (Angelin)	×				
Proampyx difformis (Angelin)	×	×			
Solenopleura cfr. *zwerevi* Lermantova			×		
Solenopleura (?) sp.	×				
Anomocare exavatum (Angelin)	×	×	×		
Anomocare limbatum (Angelin)		×	×		
Anomocare sibiricum Holm and Westergård	×		×		×
Anomocare acuticosta Lermantova			×		
Anomocare (?) sp. undt.	×				
Trilobites undt.	×				

can be referred to the *Centropleura* fauna because the first species is, according to Holm and Westergard, identifiable with *Anomocare sibiricum* while in my opinion (1939) the second belongs to either *Clavagnostus* or *Peronopsis* unless it represents an undescribed genus by itself. Furthermore, occurrences of the same fauna are known from

1) a limestone conglomerate exposed along the Maja river between the mouths of the Tscharskaja and Tschabda (Loc. B; Obrutschew, 1924),
2) the Muda series on the southern slope of the Anabar massive (Loc. C; Vologdin, 1937 B) and
3) in the Kuznetsk basin and its adjacence (Loc. D, Spéransky and Oussov, 1937, Yavorsky, 1937, and Formitchev 1937).

The occurrence of *Anomocare* and probably *Paradoxides* in Novaya Zemlya (Yermolaev, 1937) points out that this fauna migrated along the Arctic coast of Europe into Siberia where it developed, and went probably farther into Kirghiz whence *Anomocare* and *Agnostus* are reported. A fossil list (I) of the copious *Centropleura* fauna of Siberia is inserted here.

Among the trilobites collected by Tolmachoff in a red marl on the left shore of the Koutui River, about 10 miles above the mouth of the second river, the following species can be distinguished:

Homagnostus euryrachis Kobayashi
Clavagnostus repandiformis Kobayashi
Girandia typa Kobayashi
Kotuia anomocaroides Kobayashi
Solenoparia megalops Kobayashi
Solenoparia brevifrons Kobayashi
Manchuriella (?) *disparilis* Kobayashi

The second species is a close relative of *Clavagnostus repandus* and likewisely the alliance of *Kotuia* to *Anomocare* is very close. *Solenoparia* is however a common genus in the Changhian of Eastern Asia while *Homagnostus* is a cosmopolitan in the Upper Cambrian period. Therefore this fauna is, I think, a little younger than the preceding, and probably of the latest Middle Cambrian. At this time the Siberian Sea probably became confluent with that of Eastern Asia.

The next younger is the *Koldinia* fauna which has first been found in the South Island of Novaya Zemlya by Holtedahl (1924) during the Norwegian Expedition in 1921 (Loc. F in list II). When Walcott and Resser described it in 1924–1925, they concluded that it is Ozarkian, but as already discussed elsewhere (Kobayashi, 1935 B, 1937, 1943 B), its early Cambrian age is beyond doubt, and this conclusion was accepted by Howell and Lochman (1939). It has been found recently that the fauna of the same or similar aspect is extensively distributed in Central Siberia. It occurs in the upper part of the Giranda river and also on the shore of the Moyero river above the mouth of the Uchkucha river, both in the Chatanga-Anabar basin (Loc. G), and in the adjacence of the Kuznetsk basin (Loc. H; Spéransky and Oussov, 1937, and Fomitchev, 1937), as shown in the fossil-list II.

Leaving out of consideration the numerous genera and species which are endemic to the Koldinian province there are several early Olenidian and early Croixan members. Therefore it is certain that the

Siberian Sea at the time was connected with the Scandinavian on one side and with the North American on the other, through Novaya Zemlya. Although Walcott once suggested its alliance to the Chaumitian fauna, its relation with Eastern as well as Central Asiatic faunas cannot be well recognized. Notwithstanding the fact that the Torsuqtagh

Fossil List II. The *Koldinia* Fauna of Siberia and Novaya Zemlya.

Locality. (See page 210)	F	G	H
Obolus (*Westonia*) sp. undt.	×		
Lingulella arctica Walcott	×		
Lingulella cfr. *desiderata* Walcott	×		
Acrotreta sp. undt.	×		
Billingsella holtedahli Walcott	×		
Billingsella coloradensis Shumard			×
Billingsella (?) *oppinus* Walcott	×		
Eoorthis sabus Walcott	×		
Huenella triplicata Walcott	×		
Linguloid undt.		×	
Agnostus pisiformis Linné	×		×
Homagnostus holtedahli (Walcott and Resser) (+*Agnostus septentrionalis* Walcott and Resser)	×		
Pseudagnostus cyclopyge (Tullberg)			×
Irvingella septentrionalis Walcott and Resser	×		
Irvingella (?) *arctica* Walcott and Resser	×		
Schmidtaspis sibiricus Kobayashi		×	
Solenopleura arctica Walcott and Resser	×		
Modocia obrutschewi Kobayashi		×	
Bowmania lermantovae Kobayashi		×	
Acrocephalites vigilans Walcott and Resser	×		
Acrocephalites sp.			×
Pesaia latifrons Walcott and Resser	×		
Pesaia exsculpta Walcott and Resser	×		
Kaninia lata Walcott and Resser	×		
Kaninia divaricans Walcott and Resser	×		
Kaninia (?) *speciosa* Walcott and Resser	×		
Kaninia (?) *crassimarginata* Walcott and Resser	×		
Orlovia arctica Walcott and Resser	×		
Orlovia sp.	×		×
Lecanopleura (?) *glabellae* Kobayashi		×	
Dolgaia megalops Walcott and Resser	×		
Kazelia speciosa Walcott and Resser	×		
Koldinia typa Walcott and Resser	×		
Koldinia micropthalmus Kobayashi		×	
Koldinia minor Kobayashi		×	
Koldinia sp.			×
Hypostoma undt.		×	
Pydidium undt.		×	

fauna of Eastern Tienshan is also related to the Olenidian fauna intimately (Troedsson, 1937) it is quite distinct from the Koldinian, this fact of faunal difference suggesting that the Salair movement cut off the communication between the two areas which had existed in the *Centropleura* stage.

Little is known of the late Upper Cambrian fauna of Siberia; in fact the following is about all that is known at present:

1) *Pseudagnostus cyclopyge, Pagodia walcotti, Kingstonia, Apatokerphaloides* and *Dictyites* cfr. *dictys* from the Kuznetsk basin and its adjacence.
2) *Esseigania tolli* Kobayashi and *Plethopeltis stenorachis* Kobayashi from the shore of the Esseigan river.

The appearance of the Eastern Asiatic members in the fauna is the chief difference from the Koldinian one in faunal aspect.

Finally the fauna from the Oka stage in the Irkutsk basin (Korowin, 1928, Leuchs, 1935) is a peculiar one comprising genera of various ages, from Lower Cambrian to Ordovician, which ought to be re-studied.

In conclusion the salient facts may be summarized as follows:

1) The age of the trilobites fauna in the archaeocyathid limestone in Siberia is early Middle rather than late Lower Cambrian, its Lower Ordovician age as once suggested by Grabau (1924) being impossible.

2) The Olenellian trilobites probably invaded Siberia at sometime before the deposition of the archaeocyathid limestone while the early Middle Cambrian faunas contain Pacific or Arcto-Pacific genera beside endemic ones.

3) In the medeaval Middle Cambrian period some Paradoxidian agnostids appear in Siberia and later a *Centropleura* fauna comprising typical members of the *Paradoxides forchhammeri* zone flourished in Siberia. But in the *Solenoparia* fauna of the latest Middle Cambrian age the Paradoxidian aspect becomes indistinct whereas some resemblance with the Changhian can be seen.

4) The Koldinian fauna containing many endemic genera and species shows that the expanse from Novaya Zemlya to Central Siberia was a distinct province in the early Upper Cambrian period. The province was connected with the Scandinavian and North American ones, and in the late Upper Cambrian period, it was connected also with Eastern Asiatic province.

5) Thus the Pacific or Atlantic trilobites migrated at one time or another into Siberia. Novaya Zemlya was located on the route of the migration of the Atlantic trilobites. The fact that the Cambrian faunas of Siberia are as a whole quite distinct from those of Greenland (Poulsen, 1927) is noteworthy.

Selected References.

Batourine, V. and M. Oussov. (1937), La région du Telbess dans la Chorie Montagneuse. *XVII^e Congr. Géol. Intern. Excursion Sibérienne, Sibérie Occidentale.*

Cobbold, E. S. (1931), Additional Fossils from the Cambrian Rocks of Comley, Shropshire. *Quart. Jour. Geol. Soc. London, vol. 87.*

Edelstein, J. S. (1925), Notiz über kambrische Ablagerungen im Mimussinskgebiet. *Wjestn. d. geol, Kom. No. 1.*

Eremolaef, M. (1931), The Second Expedition of the Arctic Institute to Novaya Zemlya. *Bull. Arct. Inst. No. 12.*

Fomitchev, V. (1937), La bordure sud-ouest du bassin de Kouznetsk entre Gourievsk et le village de Békova. *XVII^e Congr. Géol. Intern. Excursion Sibérienne, Sibérie Occidentale.*

Grabau, A. W. (1924), Stratigraphy of China, Pt. 1.

Hekker, C. (1928), Über den ersten Fund von Archteocyathen in Sibirien. *Geol. Wjestn. 4, nos. 1-3.*

Holm, C. and A. H. Westergård. (1930), A Middle Cambrian Fauna from Bennett Island. *Mem. de l'Acad. des Sci. de L'URSS, Cl. Phys.-Math. vol. 21, no. 8.*

Holtedahl, O. (1924), On the Rocks Formations of Novaya Zemlya with Notes on the Paleozoic Stratigraphy of other Expedition to Novaya Zemlya 1921. *Rep. Sci. Results of the Norwegian Expedition to Novaya Zemlya, 1921, no. 22.*

Howell, B. F. and T. Kobayashi. (1933). New Cambrian and Ordovician Faunas from Northern Siberia. *Proc. Geol. Soc. Am. for 1933.*

Howell, B. F. and C. Lochmann. (1939), Succession of Late Cambrian Faunas in North Hemisphere. *Jour. Pal. vol. 13.*

Kobayashi, T. (1935 A), The Cambro-Ordovician Formations and Faunas of South Chosen, Palaeontology, Pt. 3. *Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. 2, vol. 4, Pt. 2.*

Kobayashi, T. (1935 B), Zoopalaeogeographic Change between the Upper Cambrian and Lower Ordovician Periods. *Jour. Geol. Soc. Japan, vol. 42.*

Kobayashi, T. (1937), Zoopalaeogeographic Province in Upper Cambrian and Lower Ordovician Periods. *Abstr. of Papers, Intern. XVII, Geol. Congr. Moscow.*

Kobayashi, T. (1939), On the Agnostids. *Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. 2, vol. 5, Pt. 5.*

Kobayashi, T. (1942 A), On the Dolichometopinae. *Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. 2, vol. 6, Pt. 10.*

Kobayashi, T. (1943 B), Zoopalaeogeographic province in Upper Cambrian and Lower Ordovician Periods. *Japan. Jour. Geol. Geogr., vol. 20.*

Korowin, M. K. (1928), Zur Stratigraphie des Alt paläozoikum des Amphitheaters von Irkutsk. *Wjestn. d. Geol. Kom., No. 1.*

Lavrova, M. (1932), Some data on the Geology of Pomorskaya Fjord of Matochkim Shar Strait. *Trav. Inst. Geol. Acad. Sci. U.S.S.R. p. 193-194.*

Lermantova, C. (1926 A), Some New data on the Cambrian Trilobites from the Torgoskino limestone. *Bull. Com. Geol. Leningrad, vol. 32, no. 9.*

Lermantova, C. (1926 B), On the Discovery of a Representative of the Cambrian Genus *Olenoides* Meek in the Government of Irkutsk. *Bull. de Comit. Geol. vol. 44, 8.*

Lermantova, C. (1932), Some data on the Ozarkian fauna of Novaya Zemlya. *Tran. Inst. Geol. Acad. Sci. U.S.S.R. 1, p. 195-198.*

Leuchs, K. (1935), Geologie von Asien. *Bd. 1, Th. 1.*

Nalivikin, D. (1936), Major Divisions of the Palaeozoic of the Union of Soviet Socialist Republics. *Rep. XVI. Int. Congr. 1933, vol. 1.*

Obrutschew, W. G. (1926), Geologie von Sibirien. *Fortsch. d. Geol. u. Pal. Hft. 15.*

Poletayeva, O. K. (1936), The Fauna of Cambrian Trilobites of the Sanashtikgolsk Limestone of the West Sayan. *Rec. Geol. West Siberian Region, No. 35.*

Poulsen, Chr. (1927), The Cambrian, Ozarkian and Canadian Faunas of Northwest Greenland. *Jubilaemsekspeditionen. Nord om Grønland 1920-23.*

Schmidt, Fr. (1886), Über einige neue Ostsibirischen Trilobiten und Verwandte Thiereformen. *Bull. de l'Acad. Imp. des Sci. de St.-Petersbourg, vol. 12.*

Spéransky, B. and M. Oussov. (1937), La région de Gourienvsk dans les monts Salair. *XVII^e Congr. Géol. Intern. Excursion Sibérienne, Sibérie Occidentale.*

Tschurakow, A. N. (1937), Proterozoic Glaciation of Siberia. *XVII Intern. Geol. Congr. 1937, Moscow, Abstr. of Papers.*

Toll, von E. (1899), Beiträge zur Kenntniss des Siberischen Cambriaum 1. *Mém. de l'Acad. Imp. des Sci. de St.-Peteersbourg VIII^e Ser. Cl. Phys. Math., vol. 8, no. 10.*

Troedsson, T. G. (1937), On the Cambro-Ordovician Faunas of Western Qusuqtagh, Eastern Tienshan. *The Sino-Swedish Exped. Publ. 4.*

Vologdin, A. G. (1937 A), Archaeocyatha and Algae of the Southern Slope of the Anabar Massif. *Trans. Arct. Inst. 91.*

Vologdin, A. G. (1937 B), On the Climate of Northern Asia in the Cambrian. *XVII Intern. Congr. 1937 Moskau, Abstr. of Papers.*

Vologdin, A. G. (1937 C), The Cambrian of North Asia, its Stratigraphy, Tectonics and Volcanism. *XVII Intern. Congr. 1937, Moskau, Abstr. of Papers.*

Walcott, C. D. (1914), The Cambrian Faunas of Eastern Asia, *Smiths. Misc. Coll., vol. 64, no. 1.*

Walcott, C. D. (1924), Ozarkian Brachiopods from Novaya Zemlya. *Rep. Sci. Results of the Norwegian Expedition to Novaya Zemlya, 1921, no. 25.*

Walcott, C. D. and C. E. Resser. (1925), Trilobites from the Ozarkian Sandstones of the Island of Novaya Zemlya. *Rep. Sci. Results of the Norwegian Expedition to Novaya Zemlya, 1921, no. 24.*

Whitehouse, F. W. (1936), The Cambrian Faunas of North-Eastern Australia, Pts. 1-2, Stratigraphical outline and Trilobita (Miomera). *Mem. Queensland Mus. vol. 11.*

Whitehouse F. W. (1939), The Cambrian Faunas of North-Eastern Australia. Pt. 3. The Polymerid Trilobites. *Mem. Queensland Mus., vol. 11, Pt. 3.*

Yaworsky, B. (1937), Le bassin houiller de Kouznetsk. *XVIII^e Congr. Géol. Intern. Excursion Sibérienne, Sibéire Occidentale.*

Yermolaev, M. M. (1937), Stratigraphy of Palaeozoic Deposits on Novaya Zemlya. *Intern. Geol. Congr. XVII. The Novaya Zemlya Excursion, Pt. 1.*